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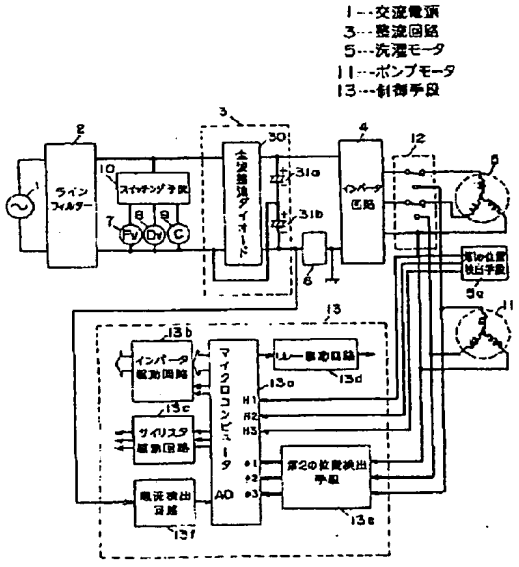
(54) **CONTROL DEVICE FOR WASHING MACHINE**

(57) Abstract:

PROBLEM TO BE SOLVED: To reduce the size and cost of an inverter circuit and a control circuit by controlling rotation of a washing motor and a pump motor by a single control circuit by setting a frequency for driving the washing motor and a frequency for driving the pump motor in the almost same in a control device of a washer for driving the pump motor for driving a pump by the inverter circuit.

SOLUTION: DC electric power of a rectifying circuit 3 connected to an AC power source 1 is converted into AC electric power by an inverter circuit 4, a washing motor 5 for driving an agitating blade or a washing tube and a pump motor 11 for driving a pump for supplying water to the washing tube are driven by this inverter circuit 4, and this inverter circuit 4 is controlled by a control means 13. The pump motor 11 is reduced in the pole number more than the pole number of the washing motor 5.



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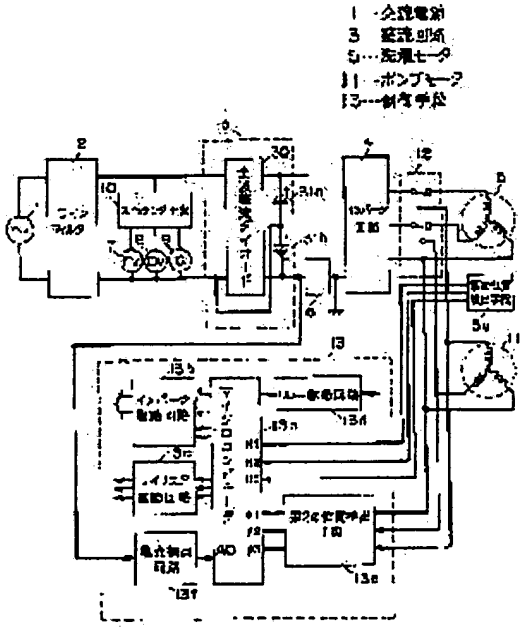

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the control unit of the washing machine with which it had AC power supply, the rectifier circuit linked to said AC power supply, the inverter circuit that changes the direct current power of said rectifier circuit into alternating current power, the wash motor which drives by said inverter circuit and drives an impeller or laundry sink, the pump motor which drives the pump which drives by said inverter circuit and supplies water to said laundry sink, and the control means which controls said inverter circuit, and said pump motor made the pole fewer than the pole of said wash motor.
[Claim 2] The control means of the inverter circuit which drives a wash motor and a pump motor is the control unit of at least one microcomputer and the washing machine according to claim 1 constituted from the circumference circuit.
[Claim 3] A pump motor is the control unit of the washing machine according to claim 1 which made the pole four or less poles.
[Claim 4] It is the control unit of the washing machine according to claim 1 which constitutes a pump motor from a non-brush direct-current motor of four or less poles which has a rotator location detection means, and detected the position signal according to back EMF which generates said rotator location detection means for the terminal of a pump motor.
[Claim 5] The control means which an inverter circuit consists of the 1st inverter circuit which drives a wash motor, and the 2nd inverter circuit which drives a pump motor, and controls said the 1st inverter circuit and said 2nd inverter circuit is the control unit of one microcomputer and the washing machine according to claim 1 constituted from the circumference circuit.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the control unit of the washing machine which makes the pump motor which drives a pump drive by the inverter circuit.
[0002]
[Description of the Prior Art] In recent years, a washing machine for home use contains the pump which absorbs water bath water etc. and supplies water in laundry sink, and after pouring water in a pump in a priming from a feed valve, the washing machine with a built-in pump which drives a pump and which supplies water in laundry sink in bath water with the so-called self-priming water pump is proposed.
[0003] Conventionally, this kind of washing machine was constituted as shown in JP,9-285687,A. That is, alternating current power was changed into direct current power by the rectifier circuit, and it was considering as the wash motor which drives an impeller or laundry sink, and the configuration which drives the pump motor which drives the pump which supplies water to laundry sink, respectively by two inverter circuits which shared DC power supply.
[0004]
[Problem(s) to be Solved by the Invention] However, with such a conventional configuration, since the inverter control device which drives a pump motor was divided into the inverter control device and another network which drive a wash motor, an inverter circuit, its control circuit, or a rotation detection means is formed in according to, respectively, and there was a fault to which a price becomes high.
[0005] The rotational frequency of the pump which absorbs water bath water and supplies water to laundry sink on the other hand has optimal 8000 r/min extent from the engine-performance side of a pump, and since the pump motor which drives this pump is directly linked with the pump, that rotational frequency is wanted to be 8000 r/min. Moreover, since a wash motor drives an impeller or laundry sink, the rotational frequency of a wash motor has optimal 1000 r/min extent.
[0006] For this reason, it was difficult for it to become indispensable requirements to change the frequency of the inverter control device which drives a pump motor, and the frequency of the inverter control device which drives a wash motor, and to carry out the inverter circuit and control circuit of a pump motor and a wash motor in common.
[0007] This invention solves a technical problem conventionally [above-mentioned], the frequency which drives a wash motor, and the frequency which drives a pump motor are made almost the same, the roll control of a wash motor and the pump motor is carried out by one control circuit, and it aims at realizing a miniaturization and low-pricing of an inverter circuit and a control circuit.
[0008]
[Means for Solving the Problem] Changing into alternating current power the direct current power of a rectifier circuit which connected with AC power supply in order that this invention might attain the above-

mentioned purpose by the inverter circuit, by this inverter circuit, the pump motor which drives the wash motor which drives an impeller or laundry sink, and the pump which supplies water to laundry sink is driven, it constitutes so that this inverter circuit may be controlled by the control means, and a pump motor makes a pole fewer than the pole of a wash motor.
[0009] Thereby, even if almost the same in the frequency which drives a wash motor, and the frequency which drives a pump motor, a predetermined rotational frequency can be obtained, respectively, the roll control of a wash motor and the pump motor can be carried out by one control circuit, and a miniaturization and low-pricing of an inverter circuit and a control circuit can be realized.
[0010]
[Embodiment of the Invention] The rectifier circuit which connected invention of this invention according to claim 1 to AC power supply and said AC power supply, The inverter circuit which changes the direct current power of said rectifier circuit into alternating current power, and the wash motor which drives by said inverter circuit and drives an impeller or laundry sink, It has the pump motor which drives the pump which drives by said inverter circuit and supplies water to said laundry sink, and the control means which controls said inverter circuit. Said pump motor Even if almost the same, the frequency which makes a pole fewer than the pole of said wash motor, and drives a wash motor, and the frequency which drives a pump motor A predetermined rotational frequency can be obtained, respectively, the roll control of a wash motor and the pump motor can be carried out by one control circuit, and a miniaturization and low-pricing of an inverter circuit and a control circuit can be realized. Moreover, it becomes easy to make the rotational frequency of a pump motor higher than a wash motor rotational frequency, it cannot be concerned with the frequency of AC power supply, but the rotational frequency of a pump motor can be made high, water supply amounts can be made [many], long lasting, a miniaturization, and ******-ization are attained, it is cheap and the control unit of a reliable washing machine can be realized.
[0011] It constitutes from at least one microcomputer and its circumference circuit, the components mark of the control means of an inverter circuit are reduced, and it can miniaturize by considering as an easy configuration, and the control means of the inverter circuit to which invention according to claim 2 drives a wash motor and a pump motor in invention given in above-mentioned claim 1 is cheap, and can realize the control unit of a reliable washing machine.
[0012] In invention given in above-mentioned claim 1, a pump motor can carry out a pole on the four or less poles, and invention according to claim 3 can make the rotational frequency of a pump motor high with the output frequency of a low inverter circuit, and can carry out the roll control of a wash motor and a pump motor with a microcomputer with slow processing speed.
[0013] Invention according to claim 4 constitutes a pump motor from a non-brush direct-current motor of four or less poles which has a rotator location detection means in invention given in above-mentioned claim 1, and said rotator location detection means detects a position signal according to back EMF generated for the terminal of a pump motor, simplifies structure of a pump motor by the so-called sensor loess drive, and can realize the control unit of the washing machine of a low price.
[0014] Invention according to claim 5 is set to invention given in above-mentioned claim 1. An inverter circuit It consists of the 1st inverter circuit which drives a wash motor, and the 2nd inverter circuit which drives a pump motor. The control means which controls said the 1st inverter circuit and said 2nd inverter circuit It constitutes from one microcomputer and its circumference circuit, and by controlling a wash motor and a pump motor by one control means, circuitry can be simplified, it is small and the control unit of a reliable cheap washing machine can be realized.
[0015]
[Example] Hereafter, the example of this invention is explained, referring to a drawing.
[0016] (Example 1) As shown in drawing 1 , AC power supply 1 applies alternating current power to a rectifier circuit 3 through a line filter 2, and changes it into direct current power. A rectifier circuit 3

constitutes a voltage doubler rectifier circuit, when AC power supply 1 is a forward electrical potential difference, it charges capacitor 31a with the full-wave-rectification diode 30, and when AC power supply 1 is a negative electrical potential difference, it charges, voltage doubler direct current voltage generates capacitor 31b in the both ends of the capacitors 31a and 31b which carried out the series connection, and it applies voltage doubler direct current voltage to an inverter circuit 4.

[0017] An inverter circuit 4 is constituted from a three-phase-circuit full bridge inverter circuit which consists of six power switching semi-conductors and reverse juxtaposition diodes, and usually consists of a power transistor, reverse juxtaposition diode, and an intelligent power module that contained the drive circuit and protection network. The wash motor 5 is connected to the output terminal of an inverter circuit 4, and the rotation drive of an impeller or the laundry sink (neither is illustrated) is carried out. By carrying out PWM control of the power transistor, a motor current is controlled and a rotational frequency is controlled.

[0018] 1st location detection means 5a detects the relative position of the permanent magnet and stator which constitute the wash motor 5 by the three-phase-circuit non-brush direct-current motor of eight or more poles, and constitute a rotator. Usually, 1st location detection means 5a consists of magnetic sensors, such as a hole IC. The current detection means 6 is connected between the negative electrical-potential-difference terminal of an inverter circuit 4, and the negative electrical-potential-difference terminal of a rectifier circuit 3.

[0019] Between the output alternating-voltage terminals of a line filter 2, a feed valve 7, a drain valve 8, and a clutch 9 are connected, and it controls by the switching means 10. A feed valve 7 constitutes tap water with the solenoid valve which supplies water to laundry sink, and constitutes the drain valve 8 with the geared motor which drains the wash water in laundry sink. A clutch 9 switches the rotation drive of an impeller or laundry sink, and constitutes it with the geared motor. The switching means 10 consists of two or more bidirection thyristors.

[0020] A pump motor 11 drives the pump which absorbs water bath water and supplies water to laundry sink, and constitutes a pump from a self-priming water pump which absorbs water after pouring water in a priming from a feed valve 7, and a pump motor 11 is the three-phase-circuit non-brush direct-current motor of four poles. Although the rotation drive of the wash motor 5 which connected the load means for switching 12 and was usually connected to the inverter circuit 4 is carried out between an inverter circuit 4 and the wash motor 5, in supplying water to laundry sink in bath water, the load means for switching 12 is switched and it connects a pump motor 11 to an inverter circuit 4.

[0021] A control means 13 controls an inverter circuit 4, the switching means 10, and the load means for switching 12, controls wash operation, and constitutes it by microcomputer 13a and its circumference circuit. Inverter drive circuit 13b drives the power switching semi-conductor of an inverter circuit 4, thyristor drive circuit 13c drives the bidirection thyristor which constitutes the switching means 10, and 13d of relay drive circuits drives the control coil of the relay which constitutes the load means for switching 12.

[0022] 2nd location detection means 13e detects back EMF generated in the terminal voltage of a pump motor 11, and detects the relative position of the rotator of a pump motor 11, and a stator. 13f of current detectors detects terminal voltage descent of the current detection means 6 which consists of non-guided very small resistance, they detect an inverter circuit current, usually detect the peak value of an inverter circuit current, and apply it to the A/D-conversion input terminal or inverter halt input terminal of microcomputer 13a.

[0023] As shown in drawing 2 , an inverter circuit 4 constitutes a power transistor from power metal-oxide semiconductor field effect transistor, and calls the power metal-oxide semiconductor field effect transistor 41a, 41b, and 41c linked to + terminal side of DC power supply, the power metal-oxide semiconductor field effect transistor 41d, 41e, and 41f by which the high-speed diodes 42a, 42b, and 42c

were connected to upper arm side power device 40a, call, and - terminal side of DC power supply, and the high-speed diodes 42d, 42e, and 42f bottom arm side power device 40b.
[0024] Power metal-oxide semiconductor field effect transistor can make the switching frequency of PWM control high, is strong to surge current and has the description which can build in high-speed diode. An insulated-gate bipolar transistor (omitting IGBT) may be used instead of power metal-oxide semiconductor field effect transistor. If the common ground of a control means 13 is connected to - side edge child of bottom arm side power device 40b, inverter drive circuit 13b can be simplified and a price can also be made cheap. Of course, you may connect with a - terminal [of a rectifier circuit 3], i.e., - terminal of capacitor 31b, side.
[0025] The load means for switching 12 is constituted from a relay of 2 sets of contacts (2 c contacts) which consist of normally-closed contacts, normally open contacts, and common terminals, connects a relay to U phase and V phase, connects the wash motor 5 to a normally-closed contact side, and connects a pump motor 11 to a normally open contact side. Even if it makes common connection of the W phase, satisfactory, since it can be constituted from one 2 c-contact relay, it can reduce components mark, and an actuation top can make a price cheap. The output signals h1, h2, and h3 of 1st location detection means 5a of the wash motor 5 are connected to the 1st position signal input terminal H1, H2, and H3 of microcomputer 13a.
[0026] 2nd location detection means 13e can detect the rotator location of a pump motor 11, can detect the terminal voltage of a pump motor 11, can detect the zero crossing point from the virtual neutral point (1/2 of a DC-power-supply electrical potential difference), and can acquire the same position signal wave as a hole IC by shifting a phase 90 degrees.
[0027] If V phase terminal is taken for an example, series connection of resistance 130a and resistance 131a linked to V phase terminal side will be carried out, it will connect with resistance 130b linked to W phase terminal side, resistance 131b, and resistance 130c and resistance 131c linked to U phase terminal side, and the virtual neutral point will be made. Smooth [of the electrical potential difference generated from the virtual neutral point to resistance 131a] is carried out by capacitor 132a, a phase is shifted, only an alternating current component is taken out by capacitor 133a and resistance 134a, and it connects with + input terminal of comparator 135a. - input terminal of comparator 135a is connected at the virtual neutral point.
[0028] Zener diode 136 is connected between the virtual neutral point and a ground, and potential is stabilized. The output signal of Comparators 135a, 135b, and 135c is applied to the 2nd position signal input terminal phi1, phi2, and phi3 of microcomputer 13a. When it connects with a pump motor 11 side by the load means for switching 12, microcomputer 13a controls an inverter circuit 4 according to the signal of the 2nd position signal input terminal phi1, phi2, and phi3. If there is no signal change of the 2nd position signal input terminal phi1, phi2, and phi3 and the 1st position signal input terminal H1, H2, and H3 has signal change, it can be judged as failure of the load means for switching 12.
[0029] Drawing 3 is the timing diagram which shows the input signal of 2nd location detection means 13e, and the relation of output voltage, and shows the terminal voltage wave (Vu, Vv, Vw) of a pump motor 11, and the relation of an output signal wave (phi1, phi2, phi3) of 2nd location detection means 13e.
[0030] Although the terminal voltage wave of a pump motor 11 will turn into a chopping wave if PWM control of the inverter circuit 4 is carried out PWM control of upper arm side power device 40a or the bottom arm side power device 40b is carried out -- being the so-called, if an integrating circuit (resistance 130a, capacitor 132a) removes a RF noise even if it carries out single-sided PWM control It becomes the same trapezoidal wave form fundamentally, and the same rotator position signal as a hole IC can be detected by shifting a phase about 1/2 to 90 of motor terminal voltage degrees.
[0031] Although the sensor loess location detector shown in drawing 2 is a method which shifts a phase

about 90 degrees by RC integrating circuit with the so-called analog form, effectiveness is the same also in the digital method which asks for a location detecting signal by the digital timer with a built-in microcomputer. A digital method usually shifts a phase about 1/2 to 30 of motor terminal voltage degrees, and calculates a phase from a rotation period.

[0032] The wash motor 5 is constituted as shown in drawing 4 , and it has 4 times of three poles of U pole 50a, V pole 50b, and W pole 50c, i.e., the salient pole of 12, and the coil (not shown) of U phase, V phase, and W phase is coiled around each, a stator 50 connects the coil of each four phases to a serial, and it makes star connection. The twice of the value (p= 4) which acted as Jo of the stator pole by 3 are the pole P of the permanent magnet 52 of a rotator 51 (P=2xp), and becomes eight pole in this case, and a non-brush direct-current motor calls the number of permanent magnets a pole.

[0033] A permanent magnet 52 arranges in a rotator by turns the thing which made N pole or the south pole magnetize a stator side. If a magnet 52a front face considers as N pole, in magnet 52b, south pole and magnet 52c will become N pole. Magnetic sensors 53a, 53b, and 53c are the location detection means of a permanent magnet 52.

[0034] Since the rotational frequency n for 1 second (r/sec) is the value (f/p) which acted as Jo of the drive frequency f by p, the relation between the rotator pole P and drive frequency f serves as n=2 f/P. Since the relation with the rotational frequency N for 1 minute (r/min) serves as N=120 f/P, if N=1000 r/min and P= 8, drive frequency f will be set to about 67Hz.

[0035] The pump motor 11 is constituted as shown in drawing 5 . Although the wash motor 5 is the inner rotor which arranged the rotator inside the stator, a pump motor 11 is the outer rotor which arranges a rotator 111 in the outside of a stator 110, and it has the permanent magnets 112a, 112b, 112c, and 112d of four poles. 113 is an outline.

[0036] If the rotational frequency of a pump motor 11 is set as 5000 - 10000 r/min in consideration of the noise and discharge quantity and it is set as 8000 r/min, inverter drive frequency will become about 267Hz on the four poles, and will become the motor 5 about 4 times the frequency of wash. If a pump motor 11 is constituted from eight poles, the number of coils not only increases, but drive frequency will be set to about 537Hz, and will have many technical problems, such as an increment in the switching loss of an inverter circuit 4, processing speed of microcomputer 13a, and an increment in motor loss, the microcomputer only for pump motor control will be needed, and a price will become high.

[0037] By reducing the pole of a pump motor 11, it becomes usable [a microcomputer with slow processing speed], and the number of motor windings can be reduced, a motor-winding process can be simplified [drive frequency of an inverter circuit 4 can be made low], and the price of a permanent magnet can also be lowered.

[0038] It explains referring to drawing 6 for the actuation at the time of pump motor 11 drive in the above-mentioned configuration. A program is started at step 200 and various initial setting is performed at step 201. It turns on relay 12, in driving a pump motor 11. The pump-priming subroutine which drives a feed valve 7 and performs predetermined period pump-priming actuation to a pump motor 11 at step 202 is performed.

[0039] Next, at step 203, a current is passed to the predetermined coil of a pump motor 11, a rotator is positioned, the forced commutation drive which makes a stator generate rotating magnetic field compulsorily at step 204 is performed, and a synchronous motor drive subroutine is performed. At this time, the rotational frequency and drive current of rotating magnetic field are raised gradually, and are made not to carry out step-out from synchronous rotation.

[0040] so that the pole of a pump motor 11 is made to increase -- the step-out at the time of a synchronous drive -- carrying out -- being hard -- since starting of a smooth rotational frequency becomes possible, it is thought that four poles of a pole are the optimal. The physical rotating-magnetic-field change include angle by the stator turns into 120 degrees, and since rotator angle of rotation is

large, in a synchronous drive, it will surely become easy to suspend rotation, if a pole is made into two poles. That is, since it becomes a synchronous drive at the time of rotation starting since the location detection at the time of a motor halt is almost the impossible in a sensor loess drive, and it becomes disadvantageous in the case of two poles, four poles are excellent.

[0041] If an inverter circuit current judges whether it is more than overcurrent detection level and becomes more than overcurrent detection level at step 205, operation of an inverter circuit 4 is suspended, an abnormality judging will be carried out, relay 12 will be turned off, it will progress to step 206 and wash operation will be continued [exception processing, such as setting an abnormality flag, is performed, and it will progress to step 207, and will switch to water supply from a feed valve 7, and]. Carry out abnormality information with an abnormality flag at the time of operation termination, nonvolatile memory is made to memorize the contents of abnormalities, and wash operation is continued. By special actuation, the display of the contents of abnormalities can be enabled also after operation termination.

[0042] In not carrying out overcurrent detection at step 205, if progress to step 208, a rotator position signal is inputted, it judges whether synchronous motor drive time amount carried out predetermined time progress at step 209 and predetermined time progress is carried out, it will judge whether it progressed to step 210 and the rotational frequency N of a pump motor 11 reached zero or more predetermined synchronous rotational frequencies Ns. Usually, this rotational frequency Ns0 is set about [of the stationary rotational frequency of a pump motor 11] to 1/10, and is set as 800 - 1000 r/min.

[0043] If the predetermined synchronous rotational frequency Ns0 is not reached, it progresses to step 211, the abnormality counter K is incremented, and it Y Comes to judge whether the abnormality counter K reached the predetermined value, and it progresses to step 206 and a predetermined value is not reached, the reboot sequence of step 212 is performed. If the reboot sequence 212 reruns the sequence from Rota positioning energization of step 203 to the rotational frequency judging of step 210 and carries out an abnormality judging again, it will set the abnormality flag in a motor, it progresses to step 206, and performs exception processing.

[0044] If it is judged as a normal rotational frequency at step 210, it will progress to step 213 and the location detection drive subroutine which generates rotating magnetic field with the position signal from 2nd location detection means 13e will be performed. At this time, if overcurrent detection is carried out at step 214, the abnormality counter K will be incremented at step 211, and an abnormality counter judging will be carried out.

[0045] If it Y Comes to judge whether location detection drive time amount carried out predetermined time progress at step 215 by step 214 when normal, and it judges whether it progressed to step 216 and the rotational frequency N of a pump motor 11 reached one or more predetermined rotational frequencies Ns and the predetermined rotational frequency Ns1 is not reached, it progresses to step 211. if normal at step 216 -- step 217 -- progressing -- about wash tank water -- a setup -- a ******** [having reached water level] -- judging -- a setup -- if water level is reached, it progresses to step 218, and the drive of a pump motor 11 will be stopped, it will progress to step 219, and relay 12 will be made to turn off

[0046] (Example 2) Below, the example 2 of this invention is explained, referring to drawing 7 . In addition, the thing of the same configuration as the above-mentioned example 1 attaches the same sign, and omits explanation.

[0047] As shown in drawing 7 , 1st inverter circuit 4a applies the voltage doubler direct current voltage of the output of a rectifier circuit 3, connects the wash motor 5 to the output terminal of this 1st inverter circuit 4a, and it constitutes it so that a roll control may be carried out by control means 13'. 1st current detection means 6a is connected between - terminal of 1st inverter circuit 4a, and - terminal of capacitor 31b.

[0048] It connects with - terminal of 1st inverter circuit 4a, and the ground of control means 13' is made into the almost same potential as the potential of the bottom arm of the power switching semi-conductor of 1st inverter circuit 4a. 2nd inverter circuit 4b is connected to capacitor 31b of a voltage doubler rectifier circuit, and juxtaposition through 2nd current detection means 6b, a pump motor 11 is connected to the output terminal, and an inverter drive is carried out.
[0049] Common connection of the - terminal of 2nd inverter circuit 4b is made with - terminal of 1st inverter circuit 4a, and it makes common connection with the ground of control means 13'. By considering as the intermediate voltage of a voltage doubler rectifier circuit, the input direct current voltage of 2nd inverter circuit 4b can lower the withstand voltage of the power switching semi-conductor of 2nd inverter circuit 4b, and has the description which can also simplify the drive circuit.
[0050] Control means 13' was constituted from one microcomputer 13a' and its circumference circuit, and has added 2nd inverter drive circuit 13b' and 13f [of current detectors of ** a 2nd]' to the example 1 shown in drawing 1 . 1st inverter drive circuit 13b can simplify circuitry by adoption of a bootstrap system and the high proof-pressure integrated circuit for an inverter drive, and 2nd inverter drive circuit 13b' can constitute the upper arm side power device of 2nd inverter circuit 4b from a darlington transistor, can constitute a bottom arm side power device from power metal-oxide semiconductor field effect transistor, and can simplify 2nd inverter drive circuit 13b' by carrying out single-sided PWM control.

[0051] 2nd current detection means 6b is what prevents destructive prevention of 2nd inverter circuit 4b, and demagnetization of the rotator permanent magnet 112 of a pump motor 11. It consists of photo couplers which carried out parallel connection to shunt resistance of about 1ohm, and shunt resistance, if an abbreviation 1A current flows, the output transistor of a photo coupler turns on, and the output signal vlb is applied to 13f [of current detection means of ** a 2nd]', and stops the drive of 2nd inverter circuit 4b.
[0052] When the wash motor 5 and a pump motor 11 are driven to coincidence, the position signal (H1, H2, H3) of the wash motor 5 inputted into microcomputer 13a' will be 3 times the drive frequency fa of 1st inverter circuit 4a. Since the position signal (phi1, phi2, phi3) of a pump motor 11 will also be 3 times the drive frequency fb of 2nd inverter circuit 4b If it totals, the signal of three (fa+fb) will be inputted in 1 second, and when the pole of a pump motor 11 increases, the microcomputer of the expensive rank in which high-speed processing is possible is needed.
[0053] Therefore, by reducing the pole of a pump motor 11, the count of processing of microcomputer 13a' can be reduced, further, by lowering the rotational frequency of the wash motor 5 at the time of pump motor 11 drive, or stopping rotation of the wash motor 5, the count of processing of microcomputer 13a' can be reduced, and the inverter drive of a pump motor 11 is attained with the microcomputer of a low price.
[0054]
[Effect of the Invention] According to invention of this invention according to claim 1, as mentioned above AC power supply, The rectifier circuit linked to said AC power supply, and the inverter circuit which changes the direct current power of said rectifier circuit into alternating current power, The wash motor which drives by said inverter circuit and drives an impeller or laundry sink, It has the pump motor which drives the pump which drives by said inverter circuit and supplies water to said laundry sink, and the control means which controls said inverter circuit. Said pump motor Since the pole was made fewer than the pole of said wash motor, even if almost the same, the frequency which drives a wash motor, and the frequency which drives a pump motor A predetermined engine speed can be obtained, respectively, the engine speed of a pump motor can be made high, and the drive frequency of an inverter circuit can be reduced. Furthermore, the number of coils of a pump motor can be reduced, it becomes usable [an inverter circuit with slow processing speed, and a microcomputer], and the control unit of a reliable

washing machine can be realized by small and the low price. Moreover, it becomes easy to make the rotational frequency of a pump motor higher than a wash motor rotational frequency, it cannot be concerned with the frequency of AC power supply, but the rotational frequency of a pump motor can be made high, water supply amounts can be made [many], long lasting, a miniaturization, and ******-ization are attained, it is cheap and the control unit of a reliable washing machine can be realized.
[0055] Moreover, according to invention according to claim 2, since it constituted from at least one microcomputer and its circumference circuit, the control means of the inverter circuit which drives a wash motor and a pump motor can simplify the circuitry of a control means, can reduce components mark, can miniaturize a control means, and can realize the control unit of a reliable washing machine by the low price.
[0056] According to invention according to claim 3, moreover, a pump motor By being able to reduce components mark, reducing inverter drive frequency further, and reducing the processing speed of a microcomputer by reducing the number of magnets of a pump motor stator winding and a rotator, since the pole was made into four or less poles The roll control by the microcomputer of a low price can be carried out, and the control unit of a washing machine with possible making the rotational frequency of a pump motor high and making the amount of pump discharges increase can be realized.
[0057] According to invention according to claim 4, moreover, a pump motor It constitutes from a non-brush direct-current motor of four or less poles which has a rotator location detection means. Said rotator location detection means Since back EMF generated for the terminal of a pump motor detected the position signal It is not necessary to reduce the number of magnets of the stator winding of a pump motor, and a rotator, and to form location detection means, such as a hole IC, in the interior of a motor. Components mark can be reduced, further, the wiring lead wire of a control means and a pump motor can be reduced, and the control unit of a reliable washing machine can be realized by the low price.
[0058] According to invention according to claim 5, moreover, an inverter circuit It consists of the 1st inverter circuit which drives a wash motor, and the 2nd inverter circuit which drives a pump motor. The control means which controls said the 1st inverter circuit and said 2nd inverter circuit Since it constituted from one microcomputer and its circumference circuit, the components mark of an inverter control circuit can be reduced. Circuitry is simplified, the miniaturization of a mounting substrate is attained and the control unit of the washing machine of small [which can be driven to coincidence], and a low price can be further realized for a wash motor and a pump motor.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the control unit of the washing machine which makes the pump motor which drives a pump drive by the inverter circuit.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] In recent years, a washing machine for home use contains the pump which absorbs water bath water etc. and supplies water in laundry sink, and after pouring water in a pump in a priming from a feed valve, the washing machine with a built-in pump which drives a pump and which supplies water in laundry sink in bath water with the so-called self-priming water pump is proposed.
[0003] Conventionally, this kind of washing machine was constituted as shown in JP,9-285687,A. That is, alternating current power was changed into direct current power by the rectifier circuit, and it was considering as the wash motor which drives an impeller or laundry sink, and the configuration which drives the pump motor which drives the pump which supplies water to laundry sink, respectively by two inverter circuits which shared DC power supply.

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EFFECT OF THE INVENTION

[Effect of the Invention] The rectifier circuit which was connected to AC power supply and said AC power supply as mentioned above according to invention of this invention according to claim 1, The inverter circuit which changes the direct current power of said rectifier circuit into alternating current power, and the wash motor which drives by said inverter circuit and drives an impeller or laundry sink, It has the pump motor which drives the pump which drives by said inverter circuit and supplies water to said laundry sink, and the control means which controls said inverter circuit. Said pump motor Since the pole was made fewer than the pole of said wash motor, even if almost the same, the frequency which drives a wash motor, and the frequency which drives a pump motor A predetermined engine speed can be obtained, respectively, the engine speed of a pump motor can be made high, and the drive frequency of an inverter circuit can be reduced. Furthermore, the number of coils of a pump motor can be reduced, it becomes usable [an inverter circuit with slow processing speed, and a microcomputer], and the control unit of a reliable washing machine can be realized by small and the low price. Moreover, it becomes easy to make the rotational frequency of a pump motor higher than a wash motor rotational frequency, it cannot be concerned with the frequency of AC power supply, but the rotational frequency of a pump motor can be made high, water supply amounts can be made [many], long lasting, a miniaturization, and ******-ization are attained, it is cheap and the control unit of a reliable washing machine can be realized.
[0055] Moreover, according to invention according to claim 2, since it constituted from at least one microcomputer and its circumference circuit, the control means of the inverter circuit which drives a wash motor and a pump motor can simplify the circuitry of a control means, can reduce components mark, can miniaturize a control means, and can realize the control unit of a reliable washing machine by the low price.
[0056] Moreover, according to invention according to claim 3, it is a pump motor, The control unit of a washing machine with possible since the pole was made into four or less poles being able to carry out the roll control by the microcomputer of a low price, making the rotational frequency of a pump motor high, and making the amount of pump discharges increase by being able to reduce components mark, reducing inverter drive frequency further, and reducing the processing speed of a microcomputer by reducing the number of magnets of a pump motor stator winding and a rotator, is realizable.
[0057] Moreover, according to invention according to claim 4, it is a pump motor, It constitutes from a non-brush direct-current motor of four or less poles which has a rotator location detection means. Said rotator location detection means Since back EMF generated for the terminal of a pump motor detected the position signal It is not necessary to reduce the number of magnets of the stator winding of a pump motor, and a rotator, and to form location detection means, such as a hole IC, in the interior of a motor. Components mark can be reduced, further, the wiring lead wire of a control means and a pump motor can be reduced, and the control unit of a reliable washing machine can be realized by the low price.

[0058] Moreover, according to invention according to claim 5, it is an inverter circuit, It consists of the 1st inverter circuit which drives a wash motor, and the 2nd inverter circuit which drives a pump motor. The control means which controls said the 1st inverter circuit and said 2nd inverter circuit Since it constituted from one microcomputer and its circumference circuit, the components mark of an inverter control circuit can be reduced. Circuitry is simplified, the miniaturization of a mounting substrate is attained and the control unit of the washing machine of small [which can be driven to coincidence], and a low price can be further realized for a wash motor and a pump motor.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, with such a conventional configuration, since the inverter control device which drives a pump motor was divided into the inverter control device and another network which drive a wash motor, an inverter circuit, its control circuit, or a rotation detection means is formed in according to, respectively, and there was a fault to which a price becomes high.
[0005] The rotational frequency of the pump which absorbs water bath water and supplies water to laundry sink on the other hand has optimal 8000 r/min extent from the engine-performance side of a pump, and since the pump motor which drives this pump is directly linked with the pump, that rotational frequency is wanted to be 8000 r/min. Moreover, since a wash motor drives an impeller or laundry sink, the rotational frequency of a wash motor has optimal 1000 r/min extent.
[0006] For this reason, it was difficult for it to become indispensable requirements to change the frequency of the inverter control device which drives a pump motor, and the frequency of the inverter control device which drives a wash motor, and to carry out the inverter circuit and control circuit of a pump motor and a wash motor in common.
[0007] This invention solves a technical problem conventionally [above-mentioned], the frequency which drives a wash motor, and the frequency which drives a pump motor are made almost the same, the roll control of a wash motor and the pump motor is carried out by one control circuit, and it aims at realizing a miniaturization and low-pricing of an inverter circuit and a control circuit.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained, referring to a drawing.
[0016] (Example 1) As shown in drawing 1 , AC power supply 1 applies alternating current power to a rectifier circuit 3 through a line filter 2, and changes it into direct current power. A rectifier circuit 3 constitutes a voltage doubler rectifier circuit, when AC power supply 1 is a forward electrical potential difference, it charges capacitor 31a with the full-wave-rectification diode 30, and when AC power supply 1 is a negative electrical potential difference, it charges, voltage doubler direct current voltage generates capacitor 31b in the both ends of the capacitors 31a and 31b which carried out the series connection, and it applies voltage doubler direct current voltage to an inverter circuit 4.
[0017] An inverter circuit 4 is constituted from a three-phase-circuit full bridge inverter circuit which consists of six power switching semi-conductors and reverse juxtaposition diodes, and usually consists of a power transistor, reverse juxtaposition diode, and an intelligent power module that contained the drive circuit and protection network. The wash motor 5 is connected to the output terminal of an inverter circuit 4, and the rotation drive of an impeller or the laundry sink (neither is illustrated) is carried out. By carrying out PWM control of the power transistor, a motor current is controlled and a rotational frequency is controlled.
[0018] 1st location detection means 5a detects the relative position of the permanent magnet and stator which constitute the wash motor 5 by the three-phase-circuit non-brush direct-current motor of eight or more poles, and constitute a rotator. Usually, 1st location detection means 5a consists of magnetic sensors, such as a hole IC. The current detection means 6 is connected between the negative electrical-potential-difference terminal of an inverter circuit 4, and the negative electrical-potential-difference terminal of a rectifier circuit 3.
[0019] Between the output alternating-voltage terminals of a line filter 2, a feed valve 7, a drain valve 8, and a clutch 9 are connected, and it controls by the switching means 10. A feed valve 7 constitutes tap water with the solenoid valve which supplies water to laundry sink, and constitutes the drain valve 8 with the geared motor which drains the wash water in laundry sink. A clutch 9 switches the rotation drive of an impeller or laundry sink, and constitutes it with the geared motor. The switching means 10 consists of two or more bidirection thyristors.
[0020] A pump motor 11 drives the pump which absorbs water bath water and supplies water to laundry sink, and constitutes a pump from a self-priming water pump which absorbs water after pouring water in a priming from a feed valve 7, and a pump motor 11 is the three-phase-circuit non-brush direct-current motor of four poles. Although the rotation drive of the wash motor 5 which connected the load means for switching 12 and was usually connected to the inverter circuit 4 is carried out between an inverter circuit 4 and the wash motor 5, in supplying water to laundry sink in bath water, the load means for switching 12 is switched and it connects a pump motor 11 to an inverter circuit 4.
[0021] A control means 13 controls an inverter circuit 4, the switching means 10, and the load means for

switching 12, controls wash operation, and constitutes it by microcomputer 13a and its circumference circuit. Inverter drive circuit 13b drives the power switching semi-conductor of an inverter circuit 4, thyristor drive circuit 13c drives the bidirection thyristor which constitutes the switching means 10, and 13d of relay drive circuits drives the control coil of the relay which constitutes the load means for switching 12.

[0022] 2nd location detection means 13e detects back EMF generated in the terminal voltage of a pump motor 11, and detects the relative position of the rotator of a pump motor 11, and a stator. 13f of current detectors detects terminal voltage descent of the current detection means 6 which consists of non-guided very small resistance, they detect an inverter circuit current, usually detect the peak value of an inverter circuit current, and apply it to the A/D-conversion input terminal or inverter halt input terminal of microcomputer 13a.

[0023] As shown in drawing 2 , an inverter circuit 4 constitutes a power transistor from power metal-oxide semiconductor field effect transistor, and calls the power metal-oxide semiconductor field effect transistor 41a, 41b, and 41c linked to + terminal side of DC power supply, the power metal-oxide semiconductor field effect transistor 41d, 41e, and 41f by which the high-speed diodes 42a, 42b, and 42c were connected to upper arm side power device 40a, call, and - terminal side of DC power supply, and the high-speed diodes 42d, 42e, and 42f bottom arm side power device 40b.

[0024] Power metal-oxide semiconductor field effect transistor can make the switching frequency of PWM control high, is strong to surge current and has the description which can build in high-speed diode. An insulated-gate bipolar transistor (omitting IGBT) may be used instead of power metal-oxide semiconductor field effect transistor. If the common ground of a control means 13 is connected to - side edge child of bottom arm side power device 40b, inverter drive circuit 13b can be simplified and a price can also be made cheap. Of course, you may connect with a - terminal [of a rectifier circuit 3], i.e., - terminal of capacitor 31b, side.

[0025] The load means for switching 12 is constituted from a relay of 2 sets of contacts (2 c contacts) which consist of normally-closed contacts, normally open contacts, and common terminals, connects a relay to U phase and V phase, connects the wash motor 5 to a normally-closed contact side, and connects a pump motor 11 to a normally open contact side. Even if it makes common connection of the W phase, satisfactory, since it can be constituted from one 2 c-contact relay, it can reduce components mark, and an actuation top can make a price cheap. The output signals h1, h2, and h3 of 1st location detection means 5a of the wash motor 5 are connected to the 1st position signal input terminal H1, H2, and H3 of microcomputer 13a.

[0026] 2nd location detection means 13e can detect the rotator location of a pump motor 11, can detect the terminal voltage of a pump motor 11, can detect the zero crossing point from the virtual neutral point (1/2 of a DC-power-supply electrical potential difference), and can acquire the same position signal wave as a hole IC by shifting a phase 90 degrees.

[0027] If V phase terminal is taken for an example, series connection of resistance 130a and resistance 131a linked to V phase terminal side will be carried out, it will connect with resistance 130b linked to W phase terminal side, resistance 131b, and resistance 130c and resistance 131c linked to U phase terminal side, and the virtual neutral point will be made. Smooth [of the electrical potential difference generated from the virtual neutral point to resistance 131a] is carried out by capacitor 132a, a phase is shifted, only an alternating current component is taken out by capacitor 133a and resistance 134a, and it connects with + input terminal of comparator 135a. - input terminal of comparator 135a is connected at the virtual neutral point.

[0028] Zener diode 136 is connected between the virtual neutral point and a ground, and potential is stabilized. The output signal of Comparators 135a, 135b, and 135c is applied to the 2nd position signal input terminal phi1, phi2, and phi3 of microcomputer 13a. When it connects with a pump motor 11 side

by the load means for switching 12, microcomputer 13a controls an inverter circuit 4 according to the signal of the 2nd position signal input terminal phi1, phi2, and phi3. If there is no signal change of the 2nd position signal input terminal phi1, phi2, and phi3 and the 1st position signal input terminal H1, H2, and H3 has signal change, it can be judged as failure of the load means for switching 12.
[0029] Drawing 3 is the timing diagram which shows the input signal of 2nd location detection means 13e, and the relation of output voltage, and shows the terminal voltage wave (Vu, Vv, Vw) of a pump motor 11, and the relation of an output signal wave (phi1, phi2, phi3) of 2nd location detection means 13e.
[0030] Although the terminal voltage wave of a pump motor 11 will turn into a chopping wave if PWM control of the inverter circuit 4 is carried out PWM control of upper arm side power device 40a or the bottom arm side power device 40b is carried out -- being the so-called, if an integrating circuit (resistance 130a, capacitor 132a) removes a RF noise even if it carries out single-sided PWM control It becomes the same trapezoidal wave form fundamentally, and the same rotator position signal as a hole IC can be detected by shifting a phase about 1/2 to 90 of motor terminal voltage degrees.
[0031] Although the sensor loess location detector shown in drawing 2 is a method which shifts a phase about 90 degrees by RC integrating circuit with the so-called analog form, effectiveness is the same also in the digital method which asks for a location detecting signal by the digital timer with a built-in microcomputer. A digital method usually shifts a phase about 1/2 to 30 of motor terminal voltage degrees, and calculates a phase from a rotation period.
[0032] The wash motor 5 is constituted as shown in drawing 4 , and it has 4 times of three poles of U pole 50a, V pole 50b, and W pole 50c, i.e., the salient pole of 12, and the coil (not shown) of U phase, V phase, and W phase is coiled around each, a stator 50 connects the coil of each four phases to a serial, and it makes star connection. The twice of the value (p= 4) which acted as Jo of the stator pole by 3 are the pole P of the permanent magnet 52 of a rotator 51 (P=2xp), and becomes eight pole in this case, and a non-brush direct-current motor calls the number of permanent magnets a pole.
[0033] A permanent magnet 52 arranges in a rotator by turns the thing which made N pole or the south pole magnetize a stator side. If a magnet 52a front face considers as N pole, in magnet 52b, south pole and magnet 52c will become N pole. Magnetic sensors 53a, 53b, and 53c are the location detection means of a permanent magnet 52.
[0034] Since the rotational frequency n for 1 second (r/sec) is the value (f/p) which acted as Jo of the drive frequency f by p, the relation between the rotator pole P and drive frequency f serves as n=2 f/P. Since the relation with the rotational frequency N for 1 minute (r/min) serves as N=120 f/P, if N=1000 r/min and P= 8, drive frequency f will be set to about 67Hz.
[0035] The pump motor 11 is constituted as shown in drawing 5 . Although the wash motor 5 is the inner rotor which arranged the rotator inside the stator, a pump motor 11 is the outer rotor which arranges a rotator 111 in the outside of a stator 110, and it has the permanent magnets 112a, 112b, 112c, and 112d of four poles. 113 is an outline.
[0036] If the rotational frequency of a pump motor 11 is set as 5000 - 10000 r/min in consideration of the noise and discharge quantity and it is set as 8000 r/min, inverter drive frequency will become about 267Hz on the four poles, and will become the motor 5 about 4 times the frequency of wash. If a pump motor 11 is constituted from eight poles, the number of coils not only increases, but drive frequency will be set to about 537Hz, and will have many technical problems, such as an increment in the switching loss of an inverter circuit 4, processing speed of microcomputer 13a, and an increment in motor loss, the microcomputer only for pump motor control will be needed, and a price will become high.
[0037] By reducing the pole of a pump motor 11, it becomes usable [a microcomputer with slow processing speed], and the number of motor windings can be reduced, a motor-winding process can be simplified [drive frequency of an inverter circuit 4 can be made low], and the price of a permanent

magnet can also be lowered.
[0038] It explains referring to drawing 6 for the actuation at the time of pump motor 11 drive in the above-mentioned configuration. A program is started at step 200 and various initial setting is performed at step 201. It turns on relay 12, in driving a pump motor 11. The pump-priming subroutine which drives a feed valve 7 and performs predetermined period pump-priming actuation to a pump motor 11 at step 202 is performed.
[0039] Next, at step 203, a current is passed to the predetermined coil of a pump motor 11, a rotator is positioned, the forced commutation drive which makes a stator generate rotating magnetic field compulsorily at step 204 is performed, and a synchronous motor drive subroutine is performed. At this time, the rotational frequency and drive current of rotating magnetic field are raised gradually, and are made not to carry out step-out from synchronous rotation.
[0040] so that the pole of a pump motor 11 is made to increase -- the step-out at the time of a synchronous drive -- carrying out -- being hard -- since starting of a smooth rotational frequency becomes possible, it is thought that four poles of a pole are the optimal. The physical rotating-magnetic-field change include angle by the stator turns into 120 degrees, and since rotator angle of rotation is large, in a synchronous drive, it will surely become easy to suspend rotation, if a pole is made into two poles. That is, since it becomes a synchronous drive at the time of rotation starting since the location detection at the time of a motor halt is almost the impossible in a sensor loess drive, and it becomes disadvantageous in the case of two poles, four poles are excellent.
[0041] If an inverter circuit current judges whether it is more than overcurrent detection level and becomes more than overcurrent detection level at step 205, operation of an inverter circuit 4 is suspended, an abnormality judging will be carried out, relay 12 will be turned off, it will progress to step 206 and wash operation will be continued [exception processing, such as setting an abnormality flag, is performed, and it will progress to step 207, and will switch to water supply from a feed valve 7, and]. Carry out abnormality information with an abnormality flag at the time of operation termination, nonvolatile memory is made to memorize the contents of abnormalities, and wash operation is continued. By special actuation, the display of the contents of abnormalities can be enabled also after operation termination.
[0042] In not carrying out overcurrent detection at step 205, if progress to step 208, a rotator position signal is inputted, it judges whether synchronous motor drive time amount carried out predetermined time progress at step 209 and predetermined time progress is carried out, it will judge whether it progressed to step 210 and the rotational frequency N of a pump motor 11 reached zero or more predetermined synchronous rotational frequencies Ns. Usually, this rotational frequency Ns0 is set about [of the stationary rotational frequency of a pump motor 11] to 1/10, and is set as 800 - 1000 r/min.
[0043] If the predetermined synchronous rotational frequency Ns0 is not reached, it progresses to step 211, the abnormality counter K is incremented, and it Y Comes to judge whether the abnormality counter K reached the predetermined value, and it progresses to step 206 and a predetermined value is not reached, the reboot sequence of step 212 is performed. If the reboot sequence 212 reruns the sequence from Rota positioning energization of step 203 to the rotational frequency judging of step 210 and carries out an abnormality judging again, it will set the abnormality flag in a motor, it progresses to step 206, and performs exception processing.
[0044] If it is judged as a normal rotational frequency at step 210, it will progress to step 213 and the location detection drive subroutine which generates rotating magnetic field with the position signal from 2nd location detection means 13e will be performed. At this time, if overcurrent detection is carried out at step 214, the abnormality counter K will be incremented at step 211, and an abnormality counter judging will be carried out.
[0045] If it Y Comes to judge whether location detection drive time amount carried out predetermined

time progress at step 215 by step 214 when normal, and it judges whether it progressed to step 216 and the rotational frequency N of a pump motor 11 reached one or more predetermined rotational frequencies Ns and the predetermined rotational frequency Ns1 is not reached, it progresses to step 211. if normal at step 216 -- step 217 -- progressing -- about wash tank water -- a setup -- a ******** [having reached water level] -- judging -- a setup -- if water level is reached, it progresses to step 218, and the drive of a pump motor 11 will be stopped, it will progress to step 219, and relay 12 will be made to turn off

[0046] (Example 2) Below, the example 2 of this invention is explained, referring to drawing 7 . In addition, the thing of the same configuration as the above-mentioned example 1 attaches the same sign, and omits explanation.

[0047] As shown in drawing 7 , 1st inverter circuit 4a applies the voltage doubler direct current voltage of the output of a rectifier circuit 3, connects the wash motor 5 to the output terminal of this 1st inverter circuit 4a, and it constitutes it so that a roll control may be carried out by control means 13'. 1st current detection means 6a is connected between - terminal of 1st inverter circuit 4a, and - terminal of capacitor 31b.

[0048] It connects with - terminal of 1st inverter circuit 4a, and the ground of control means 13' is made into the almost same potential as the potential of the bottom arm of the power switching semi-conductor of 1st inverter circuit 4a. 2nd inverter circuit 4b is connected to capacitor 31b of a voltage doubler rectifier circuit, and juxtaposition through 2nd current detection means 6b, a pump motor 11 is connected to the output terminal, and an inverter drive is carried out.

[0049] Common connection of the - terminal of 2nd inverter circuit 4b is made with - terminal of 1st inverter circuit 4a, and it makes common connection with the ground of control means 13'. By considering as the intermediate voltage of a voltage doubler rectifier circuit, the input direct current voltage of 2nd inverter circuit 4b can lower the withstand voltage of the power switching semi-conductor of 2nd inverter circuit 4b, and has the description which can also simplify the drive circuit.

[0050] Control means 13' was constituted from one microcomputer 13a' and its circumference circuit, and has added 2nd inverter drive circuit 13b' and 13f [of current detectors of ** a 2nd]' to the example 1 shown in drawing 1 . 1st inverter drive circuit 13b can simplify circuitry by adoption of a bootstrap system and the high proof-pressure integrated circuit for an inverter drive, and 2nd inverter drive circuit 13b' can constitute the upper arm side power device of 2nd inverter circuit 4b from a darlington transistor, can constitute a bottom arm side power device from power metal-oxide semiconductor field effect transistor, and can simplify 2nd inverter drive circuit 13b' by carrying out single-sided PWM control.

[0051] 2nd current detection means 6b is what prevents destructive prevention of 2nd inverter circuit 4b, and demagnetization of the rotator permanent magnet 112 of a pump motor 11. It consists of photo couplers which carried out parallel connection to shunt resistance of about 1ohm, and shunt resistance, if an abbreviation 1A current flows, the output transistor of a photo coupler turns on, and the output signal vlb is applied to 13f [of current detection means of ** a 2nd]', and stops the drive of 2nd inverter circuit 4b.

[0052] When the wash motor 5 and a pump motor 11 are driven to coincidence, the position signal (H1, H2, H3) of the wash motor 5 inputted into microcomputer 13a' will be 3 times the drive frequency fa of 1st inverter circuit 4a. Since the position signal (phi1, phi2, phi3) of a pump motor 11 will also be 3 times the drive frequency fb of 2nd inverter circuit 4b If it totals, the signal of three (fa+fb) will be inputted in 1 second, and when the pole of a pump motor 11 increases, the microcomputer of the expensive rank in which high-speed processing is possible is needed.

[0053] Therefore, by reducing the pole of a pump motor 11, the count of processing of microcomputer 13a' can be reduced, further, by lowering the rotational frequency of the wash motor 5 at the time of

pump motor 11 drive, or stopping rotation of the wash motor 5, the count of processing of microcomputer 13a' can be reduced, and the inverter drive of a pump motor 11 is attained with the microcomputer of a low price.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block circuit diagram of the control device of the washing machine of the 1st example of this invention
[Drawing 2] The important section circuit diagram of the control unit of this washing machine
[Drawing 3] The timing diagram of the 2nd location detection means of the control device of this washing machine of operation
[Drawing 4] The important section block diagram of the wash motor of the control unit of this washing machine
[Drawing 5] The important section block diagram of the pump motor of the control unit of this washing machine
[Drawing 6] The flow chart of the pump motor control program of the control device of this washing machine
[Drawing 7] The block circuit diagram of the control device of the washing machine of the 2nd example of this invention
[Description of Notations]
1 AC Power Supply
3 Rectifier Circuit
4 Inverter Circuit
5 Wash Motor
11 Pump Motor
13 Control Means

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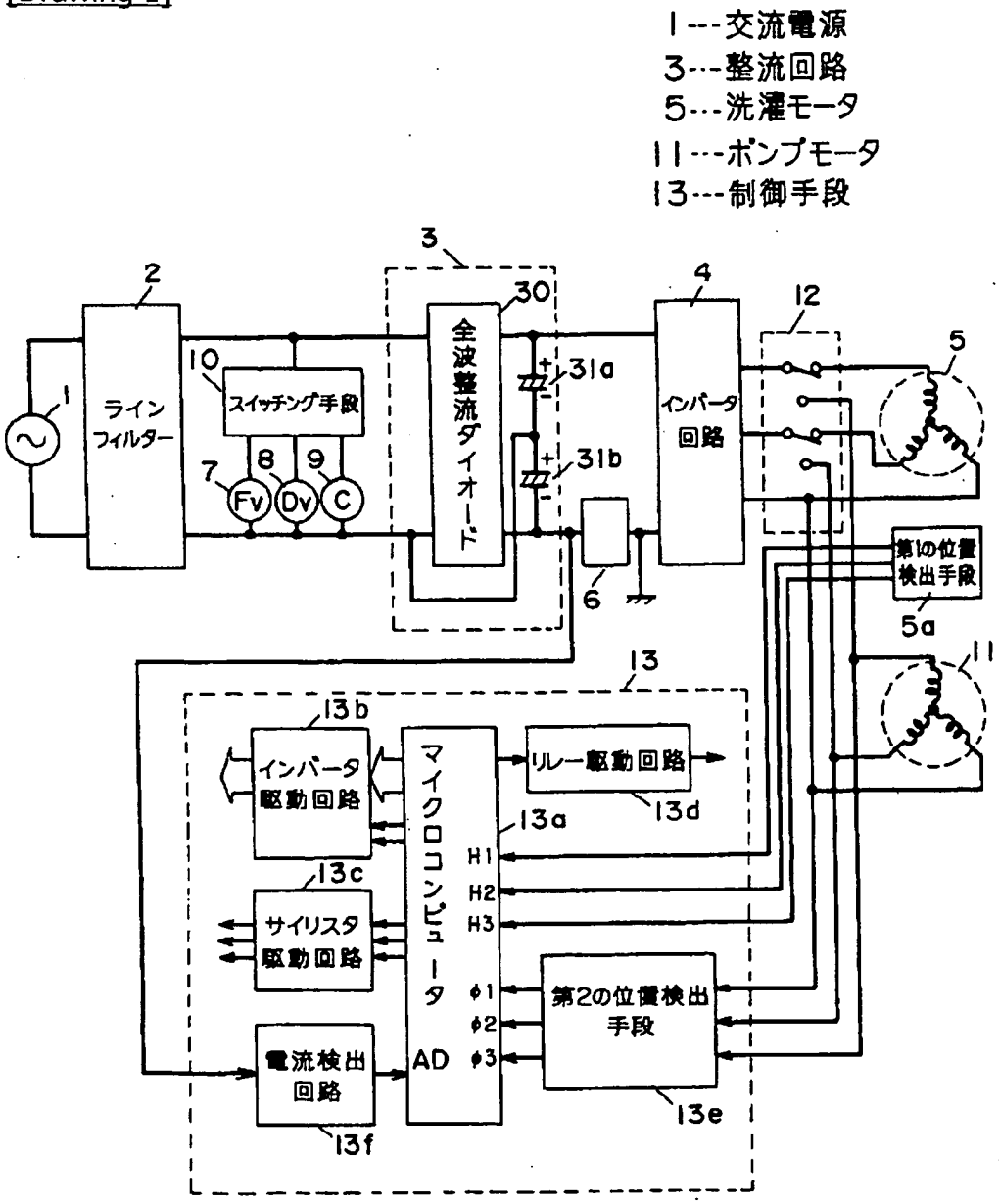
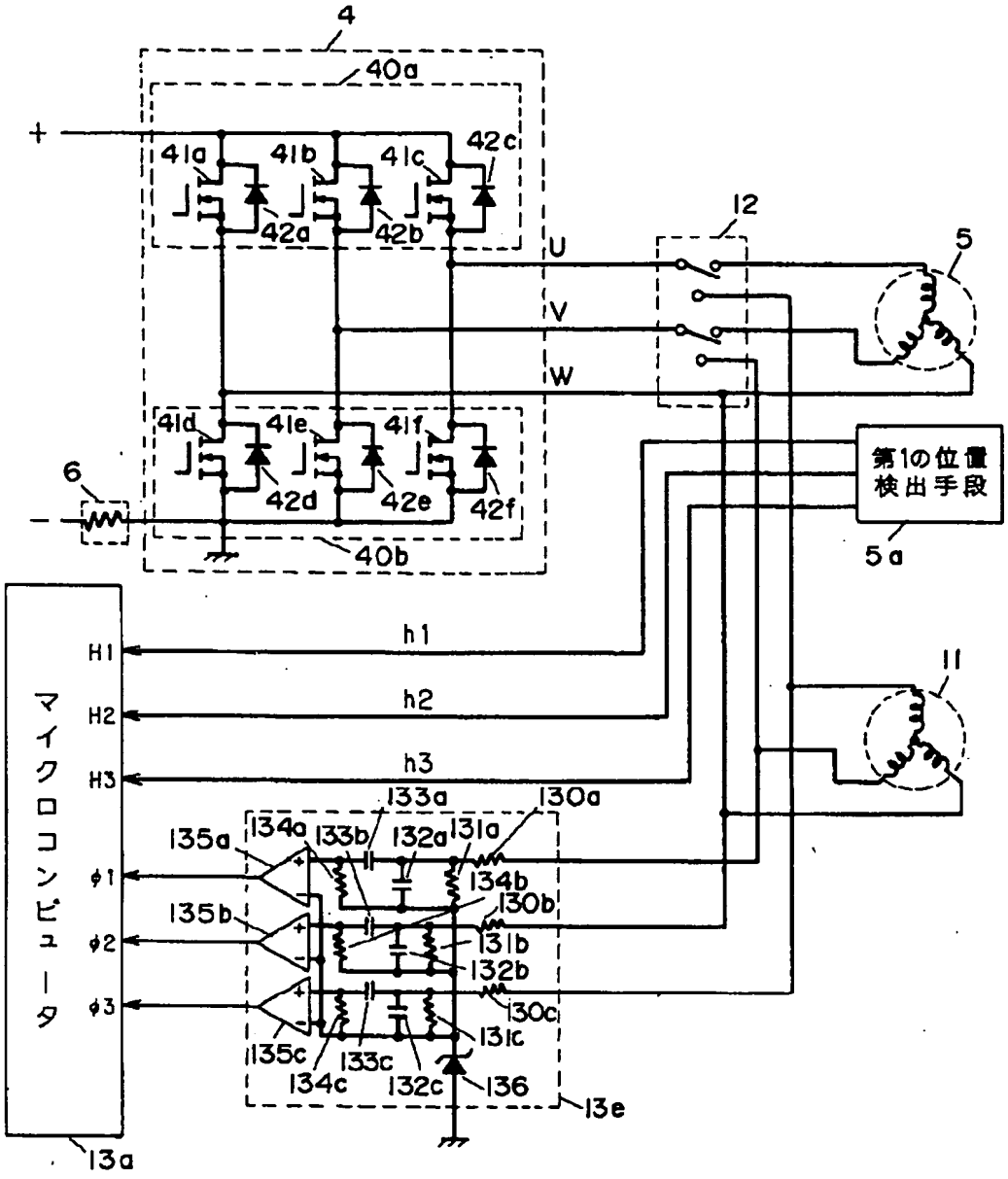
DRAWINGS

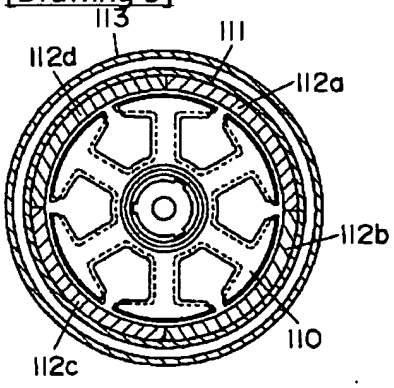
[Drawing 1]



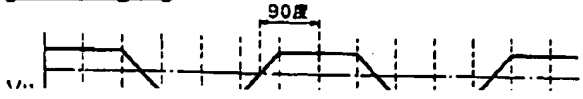
[Drawing 2]

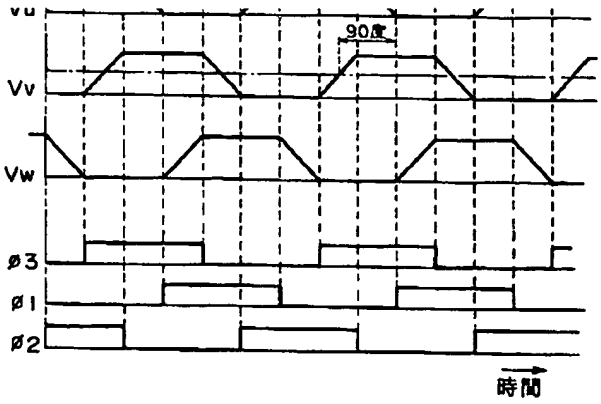


[Drawing 5]

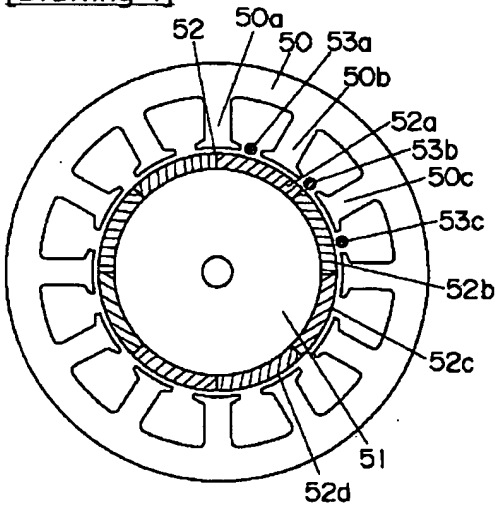


[Drawing 3]

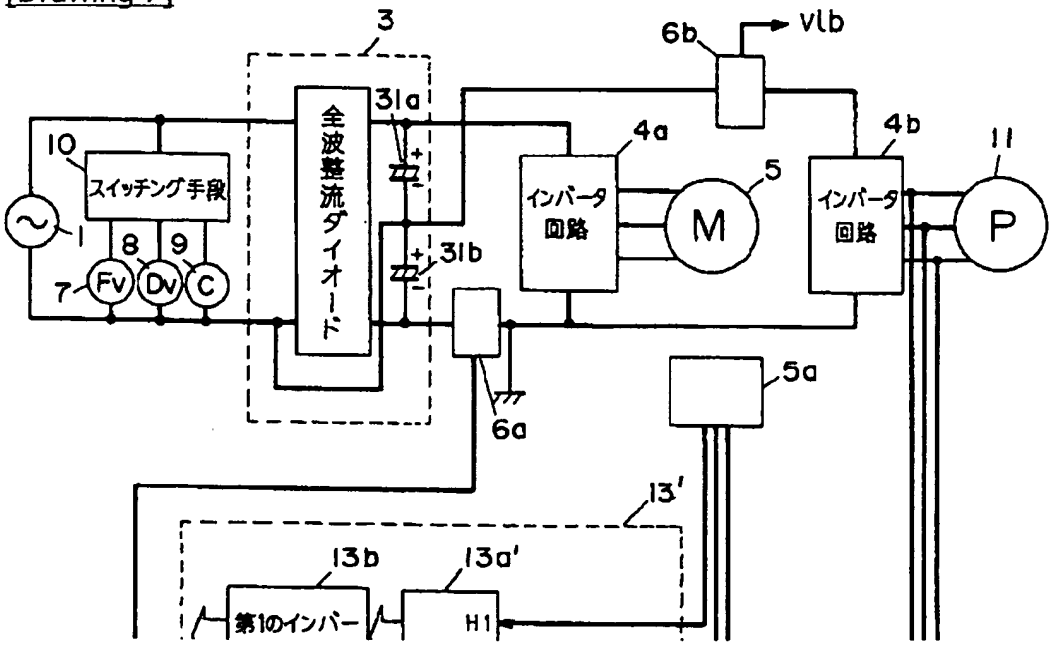


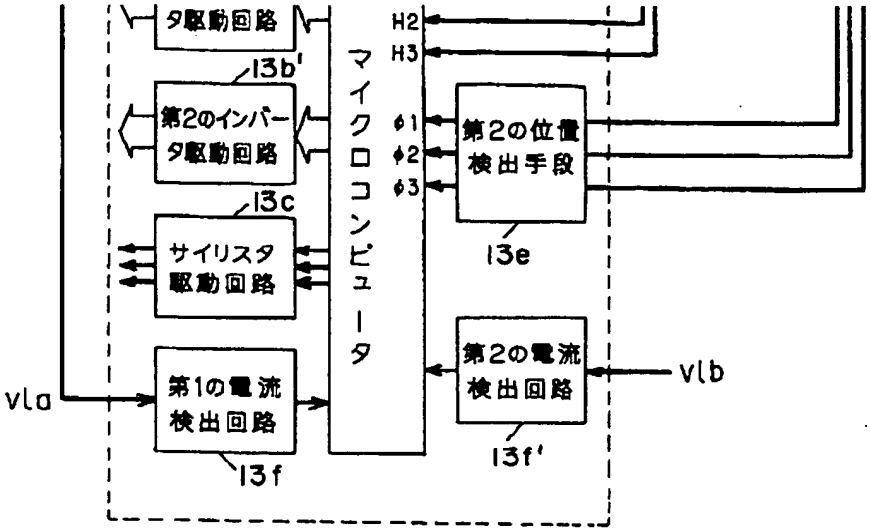


[Drawing 4]

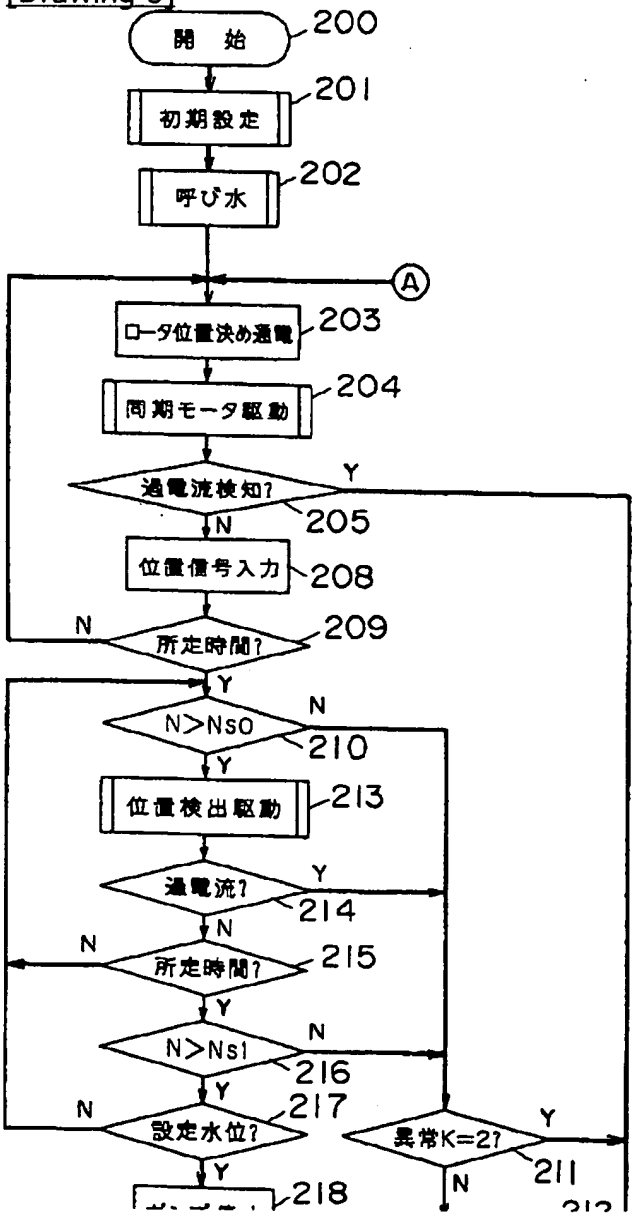


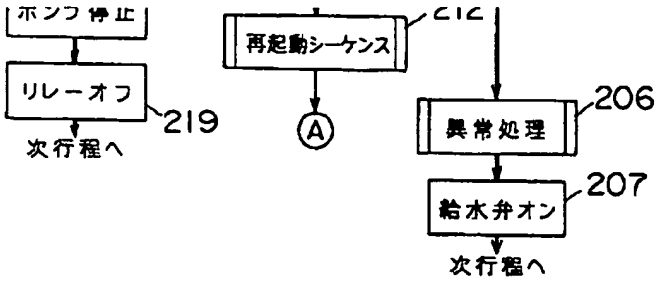
[Drawing 7]




タ駆動回路
13b'
第2のインバータ駆動回路
13c
サイリスタ駆動回路
第1の電流検出回路
13f
マイクロコンピュータ
H2
H3
φ1
φ2
φ3
第2の位置検出手段
13e
第2の電流検出回路
13f'
Vla
Vlb

[Drawing 6]


開 始
200
初期設定
201
呼び水
202
A
ロータ位置決め通電
203
同期モータ駆動
204
過電流検知?
205
Y
N
位置信号入力
208
所定時間?
209
N>Nso
210
位置検出駆動
213
過電流?
214
所定時間?
215
N>Ns1
216
設定水位?
217
異常K=2?
211
218



[Translation done.]